

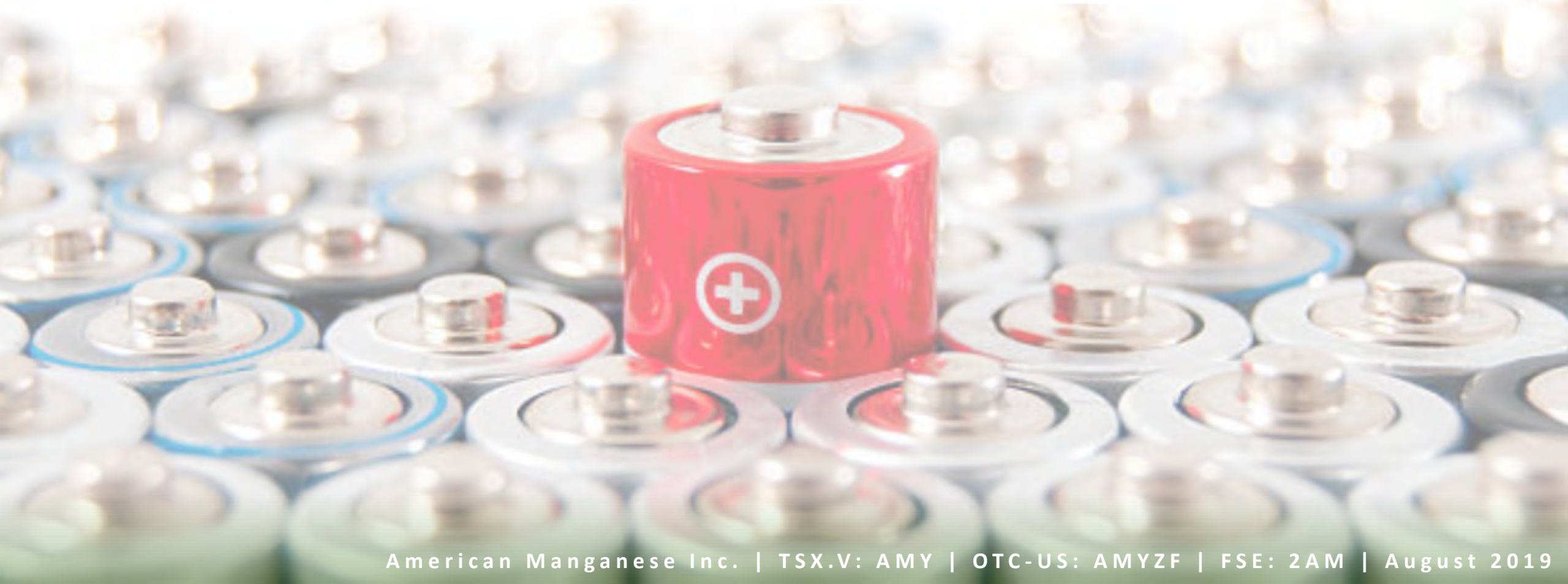
RecycLiCo™
PATENTED PROCESS

Making Lithium-ion
Last *Forever.*™

An Innovation of



AMERICAN
MANGANESE INC.



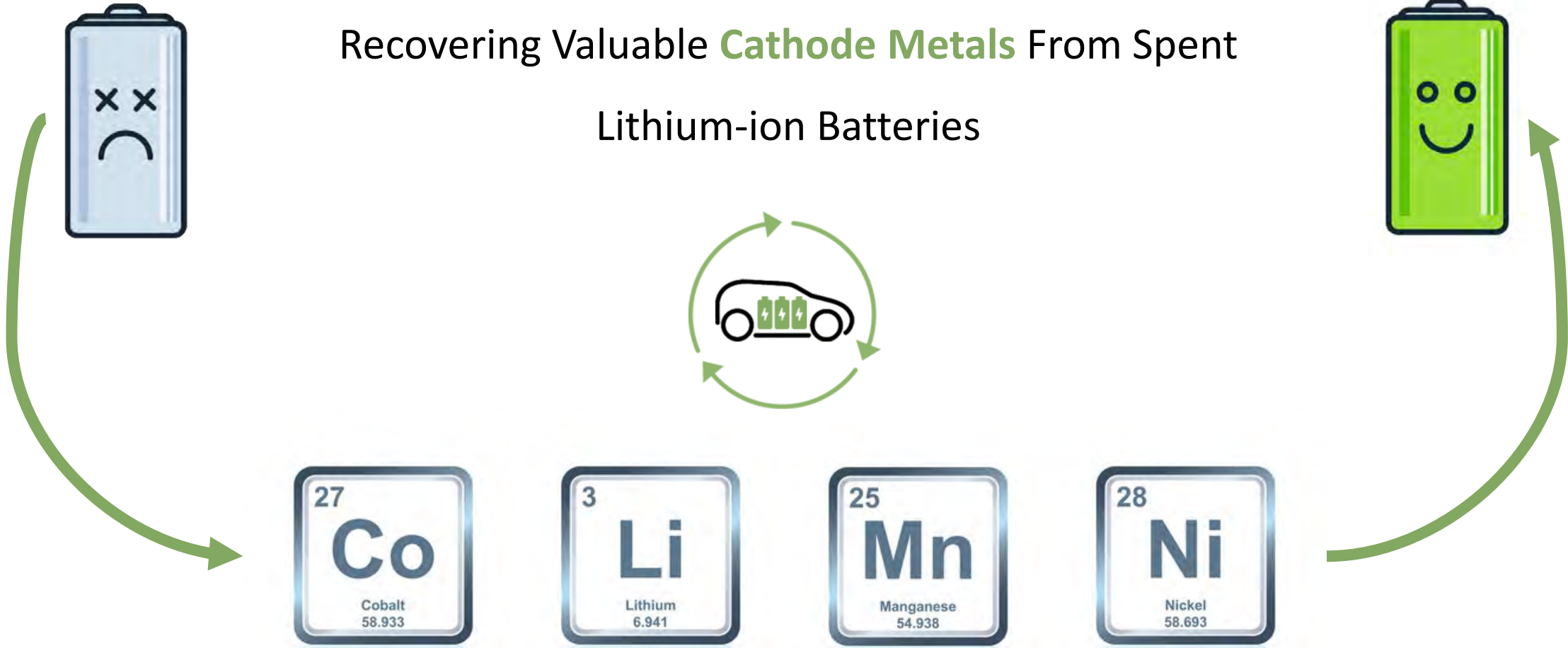
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Company Objective

Recovering Valuable **Cathode Metals** From Spent
Lithium-ion Batteries



Manganese Miner to Lithium-ion Urban Miner



Patented process (2012) for efficiently **recovering electrolytic manganese metals from low grade ores** (2-3%) such as the Company's Artillery Peak Deposit in Arizona

Contracted Kemetco Research Inc. (April 2016) to **extend existing intellectual property** on manganese into recycling cathode materials from lithium-ion batteries



Kemetco successfully recovered **100%** of the cathode materials from NMC, NCA, LCO, and LMO chemistries using the novel process

Five-stage Pilot Plant project commissioned for **recycling scrap cathode material from lithium-ion batteries** in order to replicate real world, closed-circuit conditions

Intend to commercialize intellectual property with joint venture partnerships and licensing agreements



Current Lithium-ion Battery Recycling



Current Process for Lithium-ion Battery 'Recycling'

Source: Umicore

There is an increase in spent lithium-ion battery waste and no efficient method to recover the valuable cathode materials trapped inside. Existing methods are capital intensive and consist of high heat (1,500°C) and harmful emissions with low recovery and purity of cathode materials that aren't repurposed into new batteries.



Produces nearly **700,000 tonnes of CO₂** each year



That's equivalent to **152,000 additional vehicles on the road each year**

Growing Recycling Opportunity

The need for **recycling is a certainty** and with a sustainable solution it could:

Eliminate Waste by diverting end-of-life lithium-ion batteries from landfills

Reduce Mined Raw Materials by providing recycled materials for the lithium-ion battery supply chain

Improve Manufacturing Cost by recycling cathode scrap for use in future lithium-ion cathode manufacturing

Eliminate Carbon Emissions by utilizing a closed-loop hydrometallurgical process



Planned Battery Manufacturing Capacity by 2028:

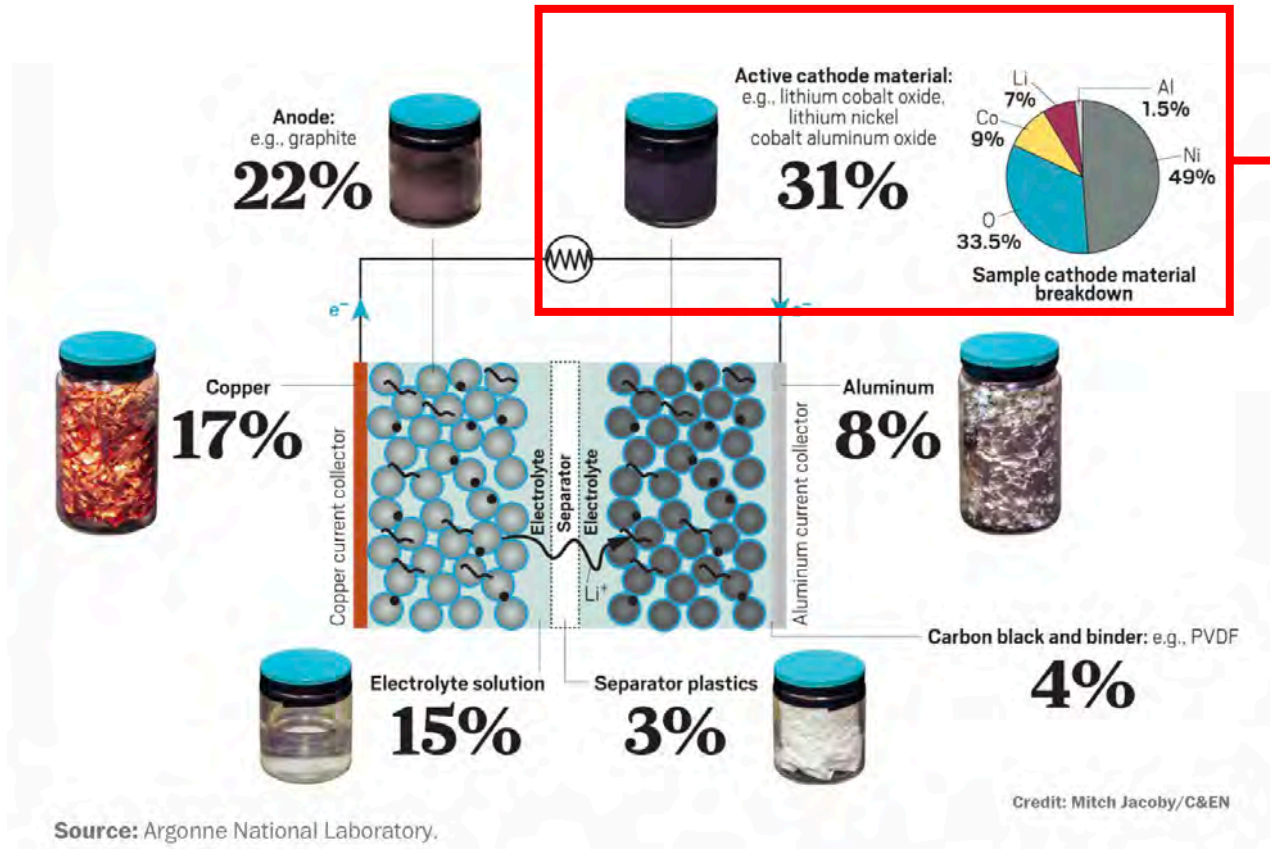
1,956,000,000 kWh



20M+ Tesla Model S Battery Packs

Inside Lithium-ion Batteries

All Components Of A Lithium-ion Battery Have Value And Can Be Recovered



Cathode material accounts for more than **50%** of the **material cost**, which can be recovered near 100% by American Manganese

Remaining material can be sustainably recycled through potential industry partners



Cathode-to-Cathode Recycling Process



- ✓ Robust Process
- ✓ No Harmful Emissions
- ✓ High Recovery and Battery Grade Purity
- ✓ Closed-Circuit Hydrometallurgical Process
- ✓ Low Energy Consumption and No High Heat

Patent No. 10,246,343

United States Patent and Trademark Office granted patent for lithium-ion battery recycling process and recovery of cathode materials on April 2, 2019

Patent No. 10,308,523

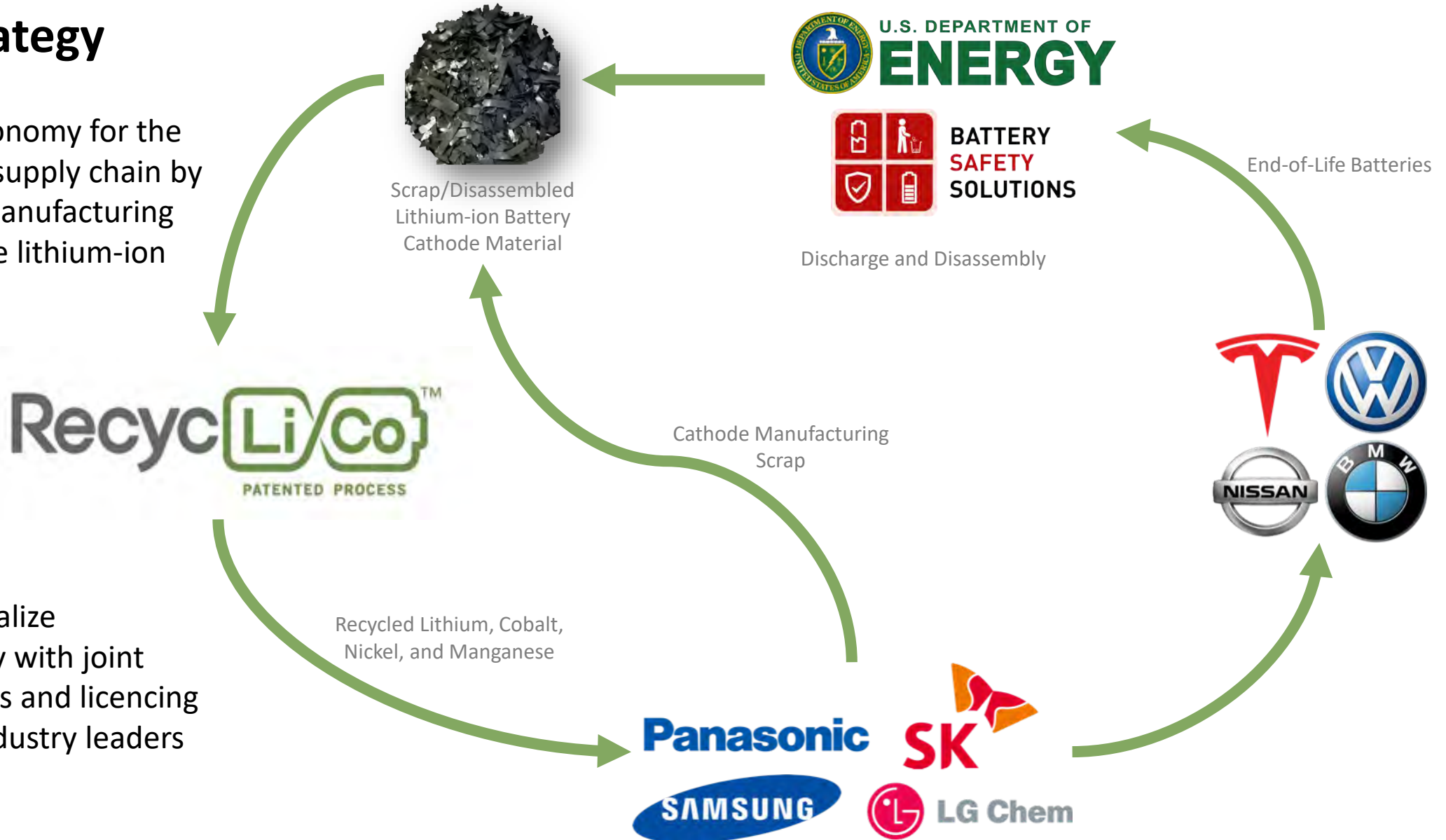
United States Patent and Trademark Office granted patent on June 4, 2019 for:

- Recovery of graphite and carbon from ground battery concentrates
- Treatment of fluoride originating from electrolyte solution
- Separation of aluminum from cathode active material

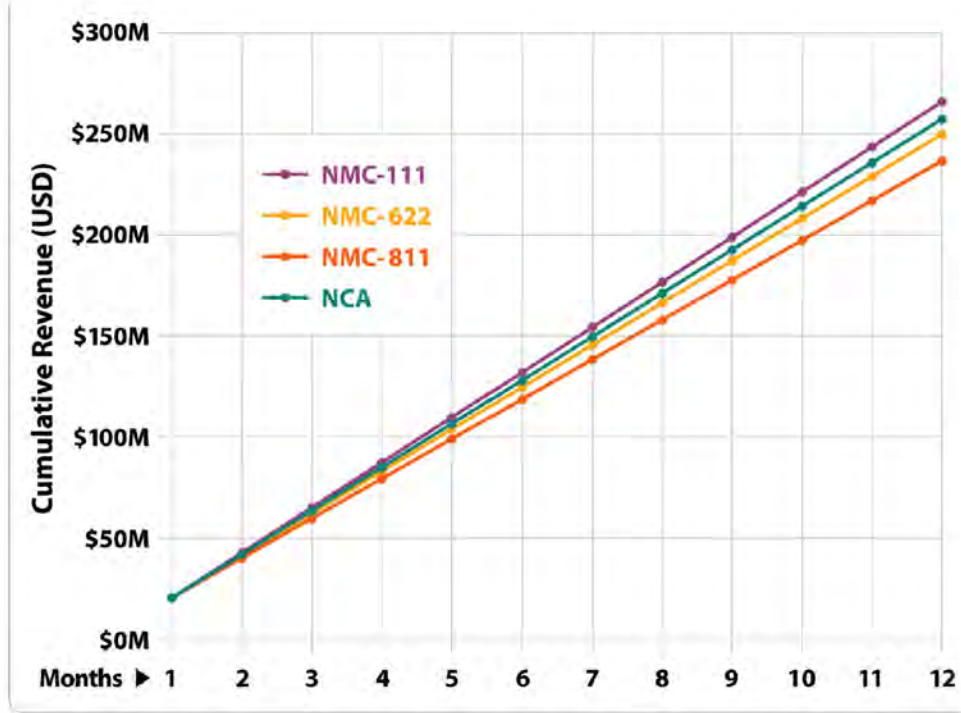
Business Strategy

Create a circular economy for the lithium-ion battery supply chain by recycling cathode manufacturing scrap and end-of-life lithium-ion batteries

Intend to commercialize intellectual property with joint venture partnerships and licencing agreements with industry leaders



Financial Model



* Revenue is based upon 95% recovery of cathode materials and commodity prices as of April 2019

Type	Li2CO3 (kg)	Co (kg)	Ni (kg)	Mn (kg)	Al (kg)
NMC-111	18,193	9,673	9,634	9,018	0
NMC-622	18,105	5,776	17,257	5,384	0
NMC-811	18,039	2,878	22,927	2,682	0
NCA	18,264	4,370	23,213	0	667

Metal	Li2CO3	Co	Ni	Mn	Al
Market Price (USD/kg)	\$14.00	\$35.00	\$13.00	\$2.00	\$2.00

Potential for highly profitable recycling of thousands of tonnes of existing and commercially available lithium-ion battery cathode scrap material.

Estimated Revenue Based Upon a **50 TPD** Pro-forma Commercial Plant

Assumed **95% Recovery** of Cathode Materials

Reagent Cost Less Than **\$1/kg** of Cathode Material Processed

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